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# The genus *Sophronia* in the Altai Mountains (Lepidoptera, Gelechiidae)

Jan Šumpich[1]

1 *National Museum of the Czech Republic, Natural History Museum, Department of Entomology, Cirkusová 1740, CZ-193 00 Praha 9 – Horní Počernice, Czech Republic; jansumpich@seznam.cz*

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**Abstract.** This work summarizes current knowledge about the occurrence of *Sophronia* Hübner, [1825] species in the Altai Mountains. Previously, two species of the genus have been recorded, both two from the Russian Altai. *Sophronia huiagaai* **sp. nov.** is described from the southern Altai Mts in Mongolia. No *Sophronia* species is known from the Chinese and Kazakh parts of the mountains. Photographs of moths and genitalia of both sexes are provided for *S. huiagaai* **sp. nov.** *S. chilonella* (Treitschke, 1833) is recorded from the Altai Mts for the first time.

## Introduction

The genus *Sophronia* Hübner, [1825] comprises 23 described species, distinguished by their ornamental forewing patterns (Šumpich et al. 2019). Central European *Sophronia* species are presented by Elsner et al. (1999), northern European species were revised by Gregersen and Karsholt (2022). Information and images on European species are available on Lepiforum (2008–2024) (https://www.lepiforum.de), and Chinese species were partly revised by Li and Zheng (1998). Šumpich et al. (2019) briefly characterized the genus, described its taxonomic placement within the family Gelechiidae, described a new species from southern Siberia (*S. salaganella* Šumpich & Bidzilya, 2019), made several taxonomic changes, and provided an updated checklist. In addition, there are four unique DNA barcode BINs lacking species names. Although unique BINs may not always represent separate species, sharing of BINs has not yet been recorded in *Sophronia*. Therefore, these four BINS likely represent additional four, hitherto undescribed species (BOLD, Ratnasingham and Hebert 2007). One of these is described here as a new species *S. huiagaai* sp. nov. Its genetic differences are comparably significant as are also characters on the ectodermal genitalia and on the external appearance of the moths.

The Altai Mountains are a nearly 2,000 km long and 600 km wide mountain range in Central Asia, straddling the border between Russia, Kazakhstan, China, and Mongolia. A high diversity of natural habitats and elevational zones in correlation with geographical location make the Altai Mountains an exceptional nature area with a high degree of plant and animal endemism. It is reported that around 2,000 species of higher plants occur in the Altai Mts, 200 of which are endemic (Wikiwand 2024). A similarly high percentage of endemism can be assumed for some insect groups, though a significant portion of the mountains has not yet been surveyed for insects. This

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is largely due to the absence of access roads, as well as overlook of certain areas by entomologists in the past. In recent decades, several research trips to the Russian Altai have been conducted by Russian, Ukrainian, Finnish, Austrian and Czech lepidopterologists, resulting in the description of many Lepidoptera species, also in the Gelechiidae (e.g. Bidzilya 2002; Huemer et al. 2017; Šumpich et al. 2020). Although the lepidopteran fauna of the Russian Altai is fairly well studied, knowledge of other regions of the Altai is limited to non-existent (for example, only scarce lepidopteran data are available from the Chinese and Kazakh parts of the range). This situation is mirrored in the genus *Sophronia*: two species, *S. chilonella* (Treitschke, 1833) and *S. salaganella* Šumpich & Bidzilya, 2019, are known from the Russian Altai, none from the Chinese and Kazakh Altai, and a single species, *Sophronia huiagaai* sp. nov., is newly described from Mongolia in this paper.

## Material and methods

### Specimens and photographic documentation

Material for this paper was collected by the author using portable light traps with ultraviolet 8W/12V tubes. The preparations of genitalia followed standard methods described e.g. by Huemer and Karsholt (1999). Pinned specimens were photographed using a Canon 750D camera fitted with a Canon MP-E-65 mm lens. Preparations of genitalia (in glycerol) were photographed using a Canon EOS 200D camera mounted to an Olympus CX31 stereomicroscope. All photos were edited in Helicon Focus 6.3.5 Pro and Adobe Photoshop CC. Photographs of specimens and genitalia preparations have been numbered; these numbers can be used to locate specimens in Lepidoptera collections, databases or other papers by the author. The terminology of genital structures follows Gregersen and Karsholt (2022).

### DNA Barcoding

The *Sophronia* specimens presented in this study were DNA barcoded at the Canadian Centre for DNA Barcoding (CCDB, Biodiversity Institute of Ontario, University of Guelph). DNA was isolated from a dry specimen leg, and barcode sequences of the mitochondrial COI gene were obtained (609–628 base-pair long segment of the 5' terminus of cytochrome c oxidase I). Details of sequenced specimens, comprising faunistic data and images, were uploaded to the Barcode of Life Data Systems (BOLD; Ratnasingham and Hebert 2007) and are now public. I have included the Barcode Index Numbers (BINs) of these species (Ratnasingham and Hebert 2013) in this paper, as well as a comparison of the results with public and private *Sophronia* data in the BOLD database.

### Abbreviations of collections

**NMPC** National Museum of the Czech Republic

## Results

### *Sophronia chilonella* (Treitschke, 1833)

Figs 7–9

**Material examined.** Russia, Altai Republic, Ulagan vill., Chulyshman valley, 51°01'03"N, 88°00'39"E, grassy steppe, rocks, 600 m, 4.–5.vii.2019, 1 ♂, (gen. prep. JŠ24054), J. Šumpich leg. (NMPC).

**Molecular data.** BIN: BOLD:AAJ3742. The intraspecific average distance of the barcode region is 0.48% (p-dist) (n = 7). The minimum distance to the nearest neighbor, an unidentified *Sophronia* species collected in Bulgaria (BOLD:ADF5021), is 6.42% (p-dist).

**Distribution.** Palearctic region (from Spain to the Far East) (Elsner et al. 1999). This species has been recorded in most of the European regions of Russia; records from Russia's Asian regions are restricted to the Altai Mts (this paper), Krasnoyarsk, Chabarovsky kray and Primorsky kray (Ponomarenko 2019).

**Remark.** The wingspan of typical European specimens of *S. chilonella* is around 12 mm, while the Altai specimen is significantly larger (15 mm). However, its genitalia fully correspond to those of European specimens.

## *Sophronia huiagaai* sp. nov.

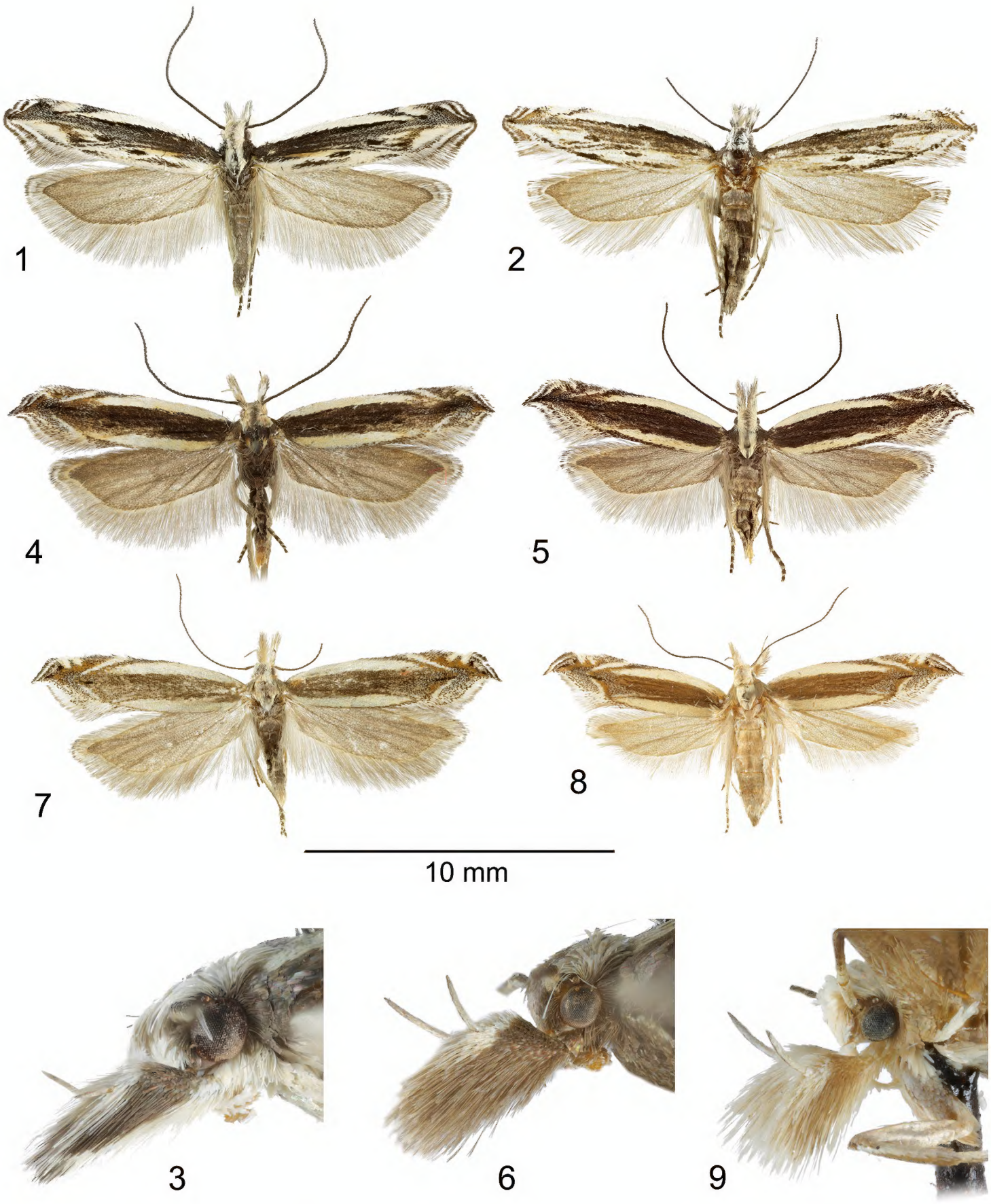
https://zoobank.org/14C84C95-05FE-4C9C-B0D7-35BB001CFAD8

Figs 1–3, 10–13

**Material examined. Type material.** Holotype ♂: Mongolia, Govi-Altai aimak, Biger District, locality „BIGER 1", 70 km SW of Biger sum, 45°51'42"N, 97°58'17"E, rocky steppe, 1660 m, 28.vi.2023 (gen. prep. JŠ 24028), Jan Šumpich leg. (NMPC). Paratypes: 8 ♂♂, 1 ♀ (DNA Barcode NMPC-LEP-1613), same data as holotype (NMPC); 1 ♂, Mongolia, Khovd aimak, Tsenkheriin gol Whalley, 6 km N of Munkhkhairkham, locality „MUNKHKHAIRKHAM", 47°6'31"N, 91°50'7"E, rocks, 2070 m, 10.vii.2023, Jan Šumpich leg. (NMPC).

**Diagnosis.** *Sophronia huiagaai* sp. nov. is an unmistakable species within the genus. In external appearance, it may somewhat resemble *S. consanguinella* (Figs 4–6) and *S. chilonella* (Figs 7–9). The dorsal margin of the forewing is white, similarly as in both these species, but in *S. huiagaai* sp. nov. it reaches the apex and has several black longitudinal stripes within. More notably, in *S. huiagaai* sp. nov., the apex of the forewing is rounded, while in *S. consanguinella* and *S. chilonella*, it is distinctly pointed. Further differences are clearly visible on the labial palpi, where the third segment is short and straight in *S. huiagaai* sp. nov., but long and curved in *S. consanguinella* and *S. chilonella*. The forewings of *S. huiagaai* sp. nov. appear nearly black and white with an overall contrasting appearance, while the central stripes of *S. consanguinella* and *S. chilonella* are dark and light brown, respectively. Regarding the male genitalia, wide and long lateromedial juxta-anellar projections are characteristic for *S. huiagaai* sp. nov. The female genitalia of this new species are characterized by a long, sclerotized antrum and a large, square-shaped signum.

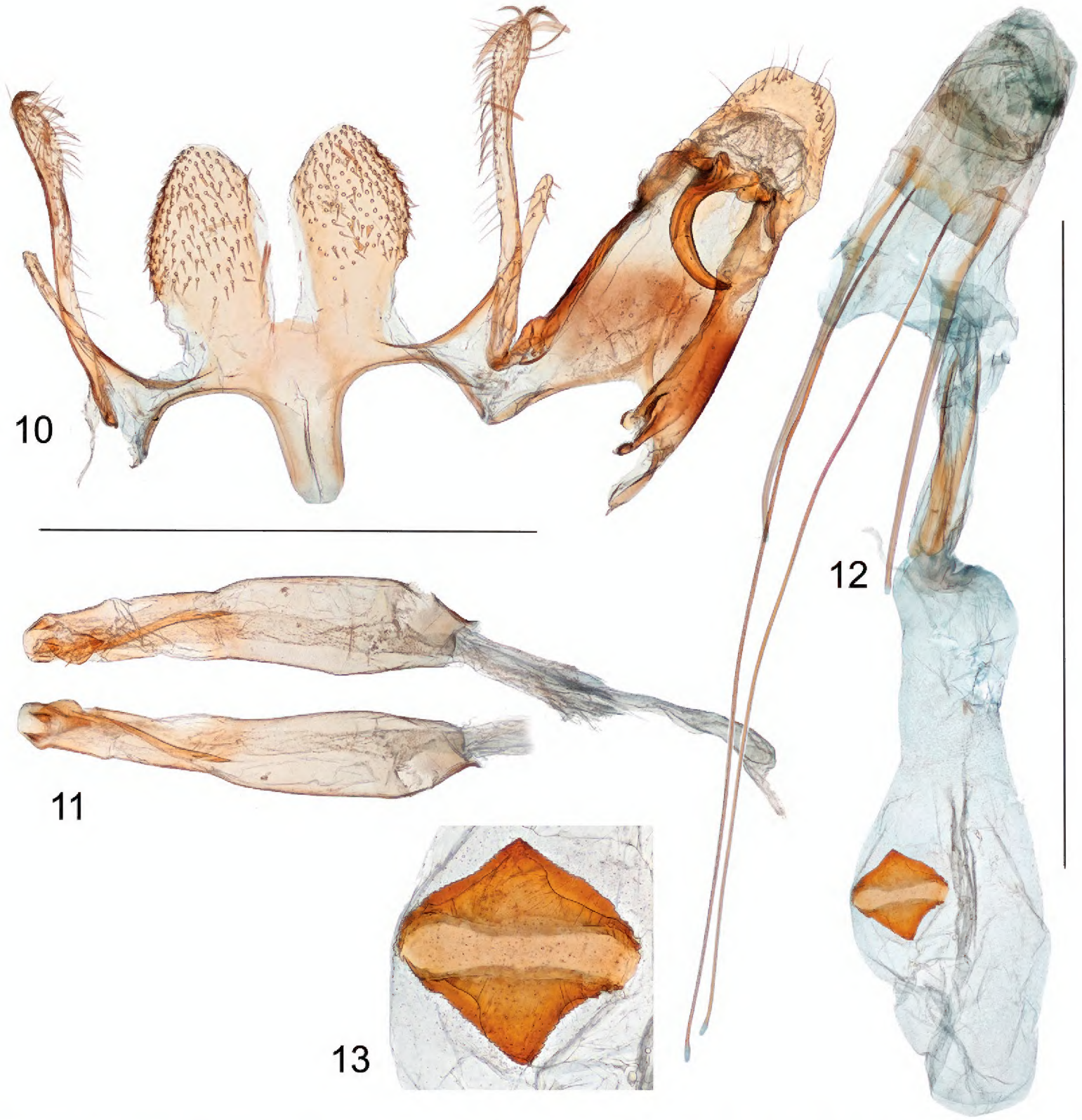
**Description.** ***External appearance*** (Figs 1–2, 5). Forewing length ♂: 15.2–16.0 mm (mean 15.8), ♀: 15 mm. Head and thorax pure white, tegulae dark brown. Antennae filiform, unicolorous dark in the first two thirds, inconspicuously ringed in the last third. The labial palpi long, the first segment covered in short white scales, the second segment with long tuft, coloured chocolate brown distally. The third segment in the form of a short and straight thorn of white colour. Forewings appear nearly black and white. Costal and dorsal fasciae pure white, one longer stripe in the subbasal part of the dorsal fascia, above it one shorter stripe in about one third of the wing and a group of smaller stripes in the last third of the wing. Apex rounded. Hindwings grey, slightly lighter at the base.




**Figures 1–9. 1–3**. *Sophronia huiagaai* sp. nov., Mongolia; **1.** Holotype, male; **2.** Paratype, female; **3.** Head, paratype, male; **4–6.** *S. consanguinella* (Herrich-Schäffer, 1855). **4.** Male, Russia, Southern Ural; **5.** Female, Czechia; **6.** Head, Czechia, male; **7–9.** *S. chilonella* (Treitschke, 1833); **7.** Male, Russia, Altai Mts; **8.** Female, Czechia; **9.** Head, Czechia, male.

***Variation.*** None. Sexual dimorphism not apparent.

***Male genitalia.*** (Figs 10–11). Uncus rectangular, distal margin of uncus even. Gnathos hook-shaped, regularly curved, apex pointed. Tegumen narrow, with triangular anteromedial invagination extending to 1/4 of its length. Valva narrow in basal 2/3, distal portion gradually broadened, apex




**Figures 10–13.** Genitalia of *Sophronia huiagaai* sp. nov., Mongolia. **10, 11.** Male genitalia, holotype; **10.** Ventral view; **11**. Different views of phallus. **12, 13.** Female genitalia; **12.** General view; **13.** Detail of signum.

rounded, extending to the top of the uncus. Juxta-anellar projections very broad and long, oval, approximately 2/3 length of valva. Vinculum very narrow. Ventral sclerite narrow, extending to middle of valva, densely spinosed distally. Saccus broad, apex rounded. Phallus straight, comparatively broad, with short internal sclerite (approximately 2.5 times shorter than the length of the aedeagus).

***Female genitalia*** (Figs 12–13). Papilla anales subovate. Apophyses posteriores very thin, longer than ductus and corpus bursae combined, apophyses anteriores two times shorter than apophyses posteriores. Antrum narrow, long, with posteriorly bifurcated sclerite. Ductus bursae and bursa copulatrix fused with no visible distinction. Signum square, anterior and posterior lobes triangular, laterally dentate.

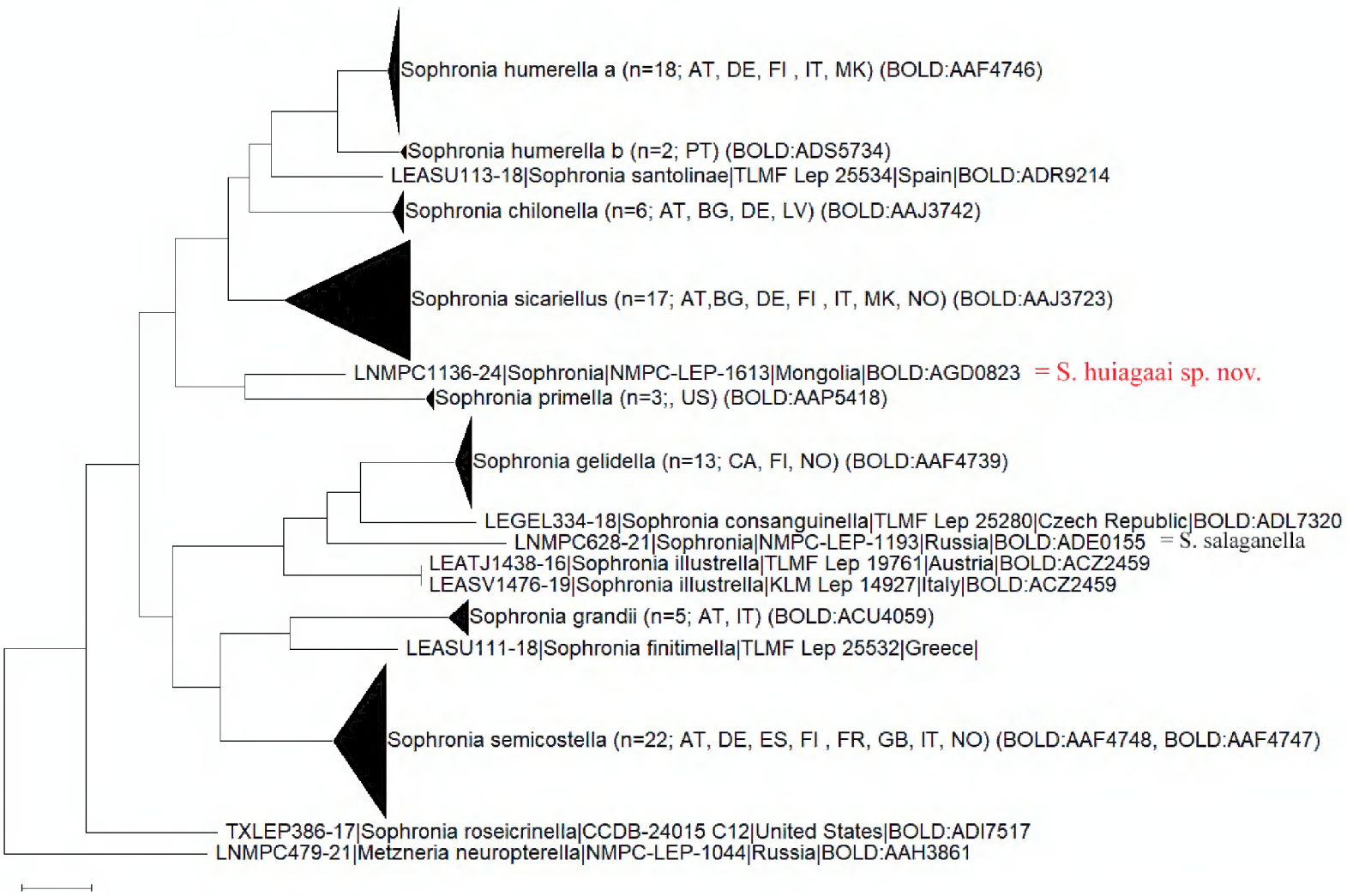

Sophronia humerella a (n=18; AT, DE, FI , IT, MK) (BOLD:AAF4746)
Sophronia humerella b (n=2; PT) (BOLD:ADS5734)
LEASU113-18|Sophronia santolinae|TLMF Lep 25534|Spain|BOLD:ADR9214
Sophronia chilonella (n=6; AT, BG, DE, LV) (BOLD:AAJ3742)
Sophronia sicariellus (n=17; AT,BG, DE, FI , IT, MK, NO) (BOLD:AAJ3723)
LNMPC1136-24|Sophronia|NMPC-LEP-1613|Mongolia|BOLD:AGD0823 = S. huiagaai sp. nov.
Sophronia primella (n=3;, US) (BOLD:AAP5418)
Sophronia gelidella (n=13; CA, FI, NO) (BOLD:AAF4739)
LEGEL334-18|Sophronia consanguinella|TLMF Lep 25280|Czech Republic|BOLD:ADL7320
LNMPC628-21|Sophronia|NMPC-LEP-1193|Russia|BOLD:ADE0155 = S. salaganella
LEATJ1438-16|Sophronia illustrella|TLMF Lep 19761|Austria|BOLD:ACZ2459
LEASV1476-19|Sophronia illustrella|KLM Lep 14927|Italy|BOLD:ACZ2459
Sophronia grandii (n=5; AT, IT) (BOLD:ACU4059)
LEASU111-18|Sophronia finitimella|TLMF Lep 25532|Greece|
Sophronia semicostella (n=22; AT, DE, ES, FI , FR, GB, IT, NO) (BOLD:AAF4748, BOLD:AAF4747)
TXLEP386-17|Sophronia roseicrinella|CCDB-24015 C12|United States|BOLD:ADI7517
LNMPC479-21|Metzneria neuropterella|NMPC-LEP-1044|Russia|BOLD:AAH3861
0.02

**Figure 14.** Neighbor-joining tree based on publicly available DNA barcodes of identified *Sophronia* specimens with *Metzneria neuropterella* (Zeller, 1839) as an outgroup species (for details see Material and methods).

**Molecular data.** BIN: BOLD:AGD0823. The intraspecific average distance of the barcode region is unknown (n = 1). The minimum distance to the nearest neighbor, the North American species *S. primella* Busck, 1907 (BOLD:AAP5418), is 6.79% (p-dist). For more details, see Fig. 14.

**Distribution.** Mongolia (Altai Mountains).

**Biology.** Early stages unknown. Adults have been collected in late June at altitudes about 1650 m, on semi-desert in low-lying areas of the Altai Mountains (Fig. 15).

**Etymology.** The species name (a noun in the genitive case) is dedicated to Altankhuyag Sosorbaram, also called Huiagaa (Mongolia, Ulaanbaatar), who accompanied me while traveling in Mongolia and created excellent conditions for my fieldwork there.

## *Sophronia salaganella* Šumpich & Bidzilya, 2019

**Material examined. Type material.** For an overview of Altaic localities in the type series, see Šumpich et al. (2019). **Additional material examined.** Russia, Altai Republic, Aktash village, 50°19'12"N, 87°36'00"E, grassy steppe, rocks, 1400 m, 29.vi.2014, 1 ♂, J. Šumpich leg. (NMPC); Kosh-Agach Distr., Kurai env., Dzhangyskol lake, 50°10'49"N, 87°44'19"E, mountain steppe, 1830 m, 29.–30.vi.2019, 1 ♂, J. Šumpich leg. (NMPC); Shebalino distr., 8 km W of Cherga, rocky slopes, steppe, 580 m, 8.–9.vii.2019, 3 ♂♂, 2 ♀♀ (DNA Barcode NMPC-LEP-1193), J. Šumpich leg. (NMPC).

**Figure 15.** Stony semi-desert near Biger sum, Mongolia, habitat of *Sophronia huiagaai* sp. nov.

**Molecular data.** BIN: BOLD:ADE0155. The intraspecific average distance of the barcode region is 1.17% (p-dist) (n = 3). The minimum distance to the nearest neighbor, *S. consanguinella* (BOLD:ADL7320), is 7.43% (p-dist).

**Distribution.** Russia (Altai Republic, Buryatia) (Šumpich et al. 2019).

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